Kramer Electronics, Ltd.

USER MANUAL

Model:

PL-8

Low Voltage Relay Controller

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1 Introduction

Welcome to Kramer Electronics! Since 1981, Kramer Electronics has been providing a world of unique, creative, and affordable solutions to the vast range of problems that confront the video, audio, presentation, and broadcasting professional on a daily basis. In recent years, we have redesigned and upgraded most of our line, making the best even better! Our 1,000-plus different models now appear in 11 groups[1] that are clearly defined by function.

Congratulations on purchasing your Kramer TOOLS: **PL-8** *Low Voltage Relay controller*, which is ideal for controlling screens, projectors, lights, security gates, and so on via the relays.

The package includes the following items:

- **PL-8** *Low Voltage Relay controller*
- Power adapter (12V DC Input)
- This user manual[2]

2 Getting Started

We recommend that you:

- Unpack the equipment carefully and save the original box and packaging materials for possible future shipment
- Review the contents of this user manual
- Use Kramer high performance high resolution cables[3]

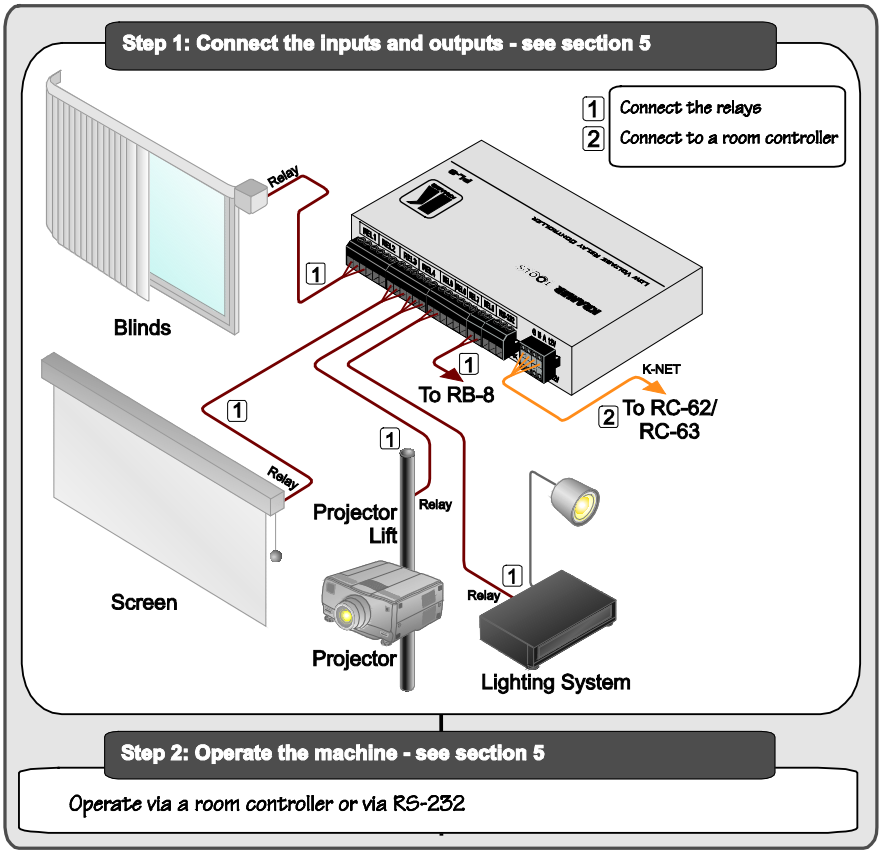
1 GROUP 1: Distribution Amplifiers; GROUP 2: Switchers and Routers; GROUP 3: Control Systems; GROUP 4: Format/Standards Converters; GROUP 5: Range Extenders and Repeaters; GROUP 6: Specialty AV Products; GROUP 7: Scan Converters and Scalers; GROUP 8: Cables and Connectors; GROUP 9: Room Connectivity; GROUP 10: Accessories and Rack Adapters; GROUP 11: Sierra Products

2 Download up-to-date Kramer user manuals from the Internet at this URL: http://www.kramerelectronics.com

3 The complete list of Kramer cables is on our Web site at http://www.kramerelectronics.com

2.1 Quick Start

This Quick start chart summarizes the basic setup and operation steps:



3 Overview

The Kramer **PL-8** is a high performance relay controller. It can connect to up to eight devices. The **PL-8** is intended to be used for the simplified and centralized control of room functions (such as lighting, closing blinds, and so on).

The **PL-8**:

- Features four relays that have normally open (NO) and normally closed (NC) contacts, and four relays that have normally open (NO) contacts
- Has a LINK LED to indicate that communication is established and an ON LED that lights when the **PL-8** receives power

- Can be controlled by Kramer SummitView™ control units such as the **SV-551**, **RC-62** and **RC-63**
- Can be upgraded via RS-232
- Is housed in a Kramer TOOLS enclosure and is 12V DC fed

Achieving the best performance means:

- Connecting only good quality connection cables, thus avoiding interference, deterioration in signal quality due to poor matching, and elevated noise levels (often associated with low quality cables)
- Avoiding interference from neighboring electrical appliances and positioning your **PL-8** away from moisture, excessive sunlight and dust

Caution – No operator-serviceable parts inside unit.

Warning – Use only the Kramer Electronics input power wall adapter that is provided with this unit[1].

Warning – Disconnect power and unplug unit from wall before installing or removing device or servicing unit.

4 Your PL-8 Low Voltage Relay Controller

Figure 1 and Table 1 define the **PL-8**:

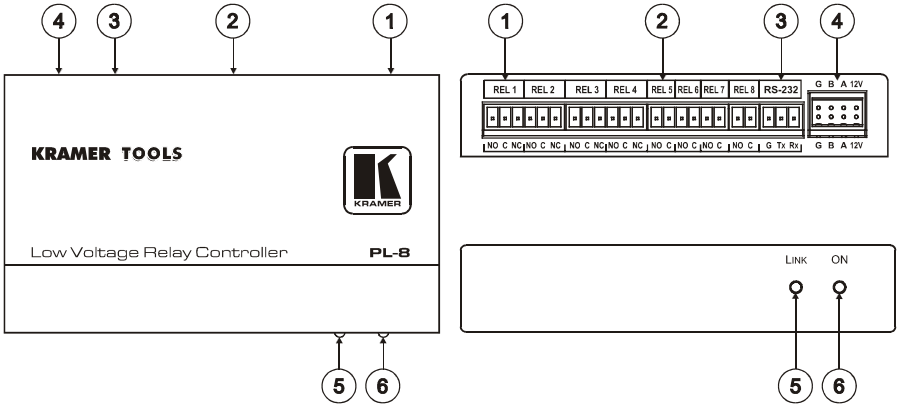


Figure 1: PL-8 Low Voltage Relay Controller

1 For example: model number AD2512C, part number 2535-000251

Table 1: PL-8 Low Voltage Relay Controller Features

#	Feature	Function
1	REL Terminal Block (from 1 to 4)	Connect to room items[1]. The PINOUT is: NO: Normally Open; C: Common Voltage; NC: Normally Closed
2	REL Terminal Block (from 5 to 8)	Connect to room items[1]. The PINOUT is: NO: Normally Open; C: Common Voltage
3	RS-232 Terminal Block	Connects to the RS-232 port on a PC
4	K-NET™[2] Terminal Block Connector	PIN GND is for the Ground connection[3]; PIN B (-) and PIN A (+) are for RS-485, and PIN +12V is for powering the unit
5	*LINK* LED	Illuminates when a link is established
6	*ON* LED	Illuminates when receiving power

Figure 2 and Table 2 define the underside of the **PL-8**. On some units the printing of the labels "RS-485 TERM" (instead of "PROGRAM") and "PROGRAM" (instead of "RS-485 TERM") may be swapped around erroneously. The correct labeling is defined in Figure 2 and Table 2.

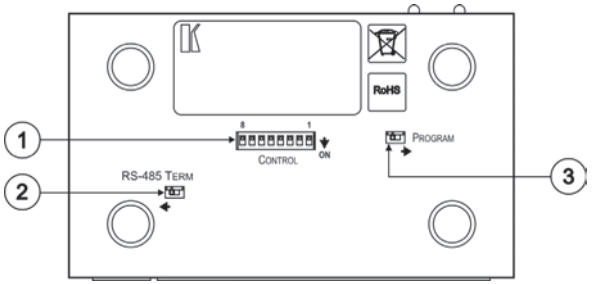


Figure 2: PL-8 Underside

Table 2: Underside Features

#	Feature	Function
1	*CONTROL* DIP-switches[4]	Set DIP 8 ON to use protocol 2000 Set DIP 8 0FF to use protocol 3000 over K-NET™
2	*RS-485 TERM* Switch	Switch for line termination of the unit
3	*PROGRAM* Switch	Switch to PROGRAM for firmware upgrade

1 Such as lighting, screen settings, blinds, and so on

2 K-NET is a proprietary Kramer protocol for interconnecting Kramer units

3 The ground connection is sometimes connected to the shield of the RS-485 cable (in most applications, it is not connected)

4 DIPs 1 to 7 are not used

5 Configuring the PL-8 Low Voltage Relay Controller

To connect the **PL-8**, as illustrated in the example in Figure 3, do the following:

1. Connect the following items to the relays[1]:
   - Window blinds to the REL 1 terminal block connector
   - A screen to the REL 3 terminal block connector
   - A projector lift to the REL 4 terminal block connector
   - The Kramer **RB-8** *8 Channel Power Controller*[2] to the REL 8 terminal block connector
2. Connect a room controller via the K-NET™ terminal block connector, see section 5.1.
   Alternatively, you can connect a PC via the RS-232 port[3] (not shown in Figure 3)[4].

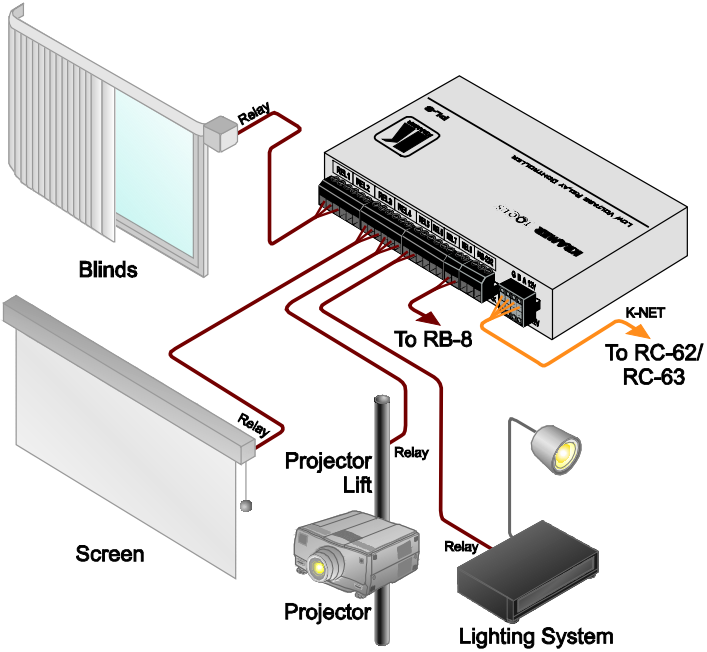


Figure 3: Connecting the PL-8 Low Voltage Relay Controller

1 You can connect up to eight relays. You do not have to connect all of them

2 Refer to the Kramer RB-8 user manual at http://www.kramerelectronics.com

3 See section 5.2

4 When controlling the PL-8 via RS-232, connect the 12V terminal block connector to a 12V power supply

5.1 The K-NET PINOUT

Figure 4 defines the K-NET™ PINOUT:

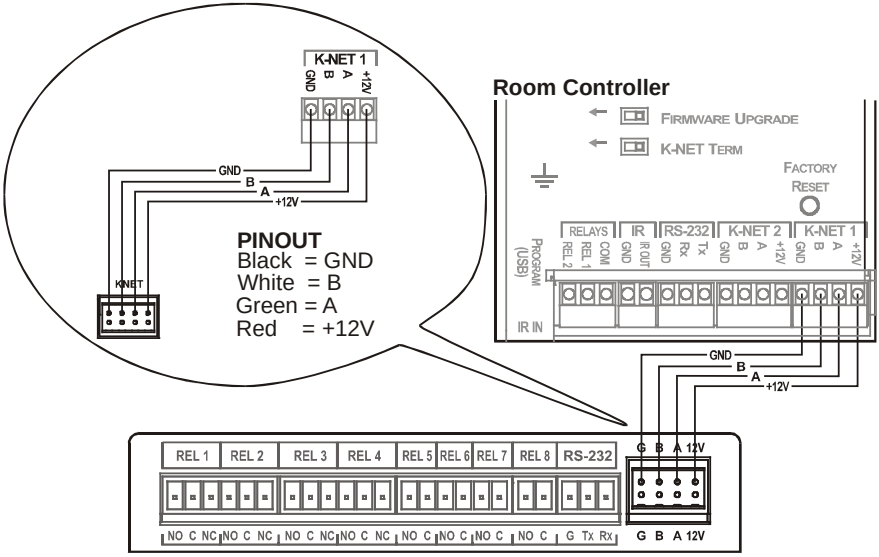


Figure 4: Wiring the K-NET Connector

5.2 The RS-232 PINOUT

The RS-232 9-pin D-sub port PINOUT is defined in Figure 5 and Table 3:

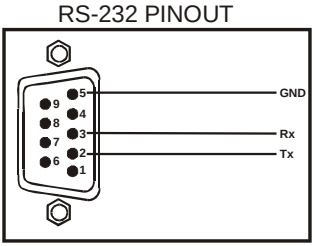


Figure 5: RS-232 PINOUT Connection

Table 3: RS-232 PINOUT Connection

Connect this PIN on the Terminal Block Connector:	To this PIN on the 9-pin D-sub Connector
Tx	PIN 2
Rx	PIN 3
GND	PIN 5

6 Firmware Upgrade

The **PL-8** firmware is located in FLASH memory, which lets you upgrade to the latest Kramer firmware version in minutes! The process involves:

- Downloading from the Internet (see section 6.1)
- Connecting the PC to the RS-232 port (see section 6.2)
- Upgrading Firmware (see section 6.3)

6.1 Downloading from the Internet

You can download the up-to-date file[1] from the Internet. To do so:

1. Go to our Web site at www.kramerelectronics.com and download the file: "*FLIP_PL8.zip*" from the Technical Support section.
2. Extract the file: "*FLIP_PL8.zip*" to a folder (for example, C:\Program Files\Kramer Flash).
3. Create a shortcut on your desktop to the file: "*FLIP.EXE*".

6.2 Connecting the PC to the RS-232 Port

Before installing the latest Kramer firmware version on a **PL-8** unit, do the following:

1. Connect the RS-232 rear panel terminal block connector according to section 5.2.
2. Disconnect the power.
3. Slide the underside switch to PROGRAM.
4. Connect the power.

6.3 Upgrading Firmware

Follow these steps to upgrade the firmware:

1. Double click the desktop icon: "*Shortcut to FLIP.EXE*".
   The Splash screen appears as follows:

1 The files indicated in this section are given as an example only. File names are liable to change from time to time

Figure 6: Splash Screen

2. After a few seconds, the Splash screen is replaced by the "*Atmel – Flip*" window:

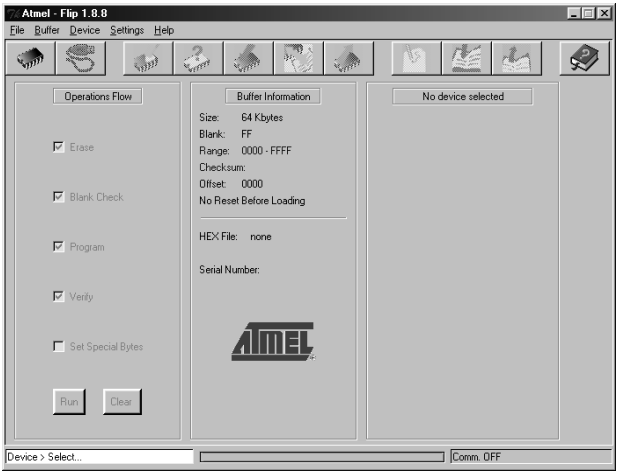


Figure 7: Atmel – Flip Window

3. Press the keyboard shortcut key *F2* (or select the "*Select*" command from the *Device* menu, or press the integrated circuit icon in the upper right corner of the window).
   The "*Device Selection*" window appears:

Figure 8: Device Selection Window

4. Click the button next to the name of the device and select from the list: AT89C51RD2:

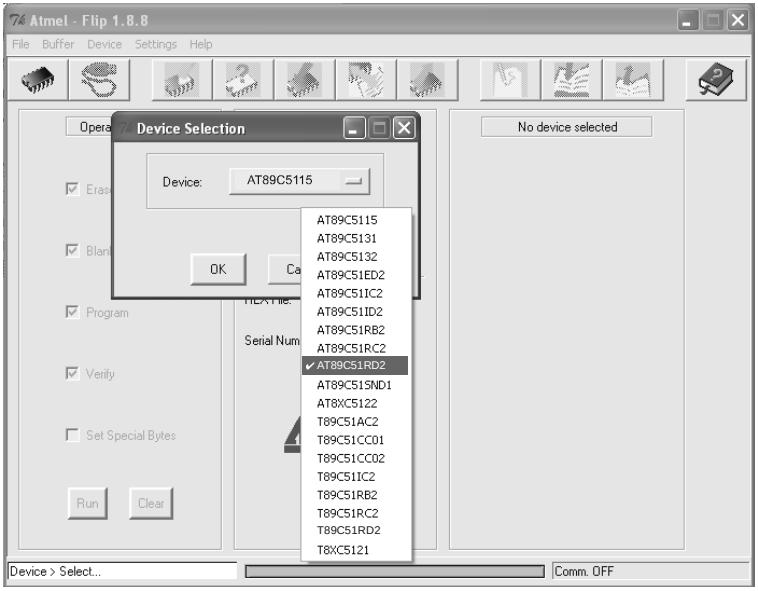


Figure 9: Device Selection window

5. Click OK and select "*Load Hex*" from the *File* menu.

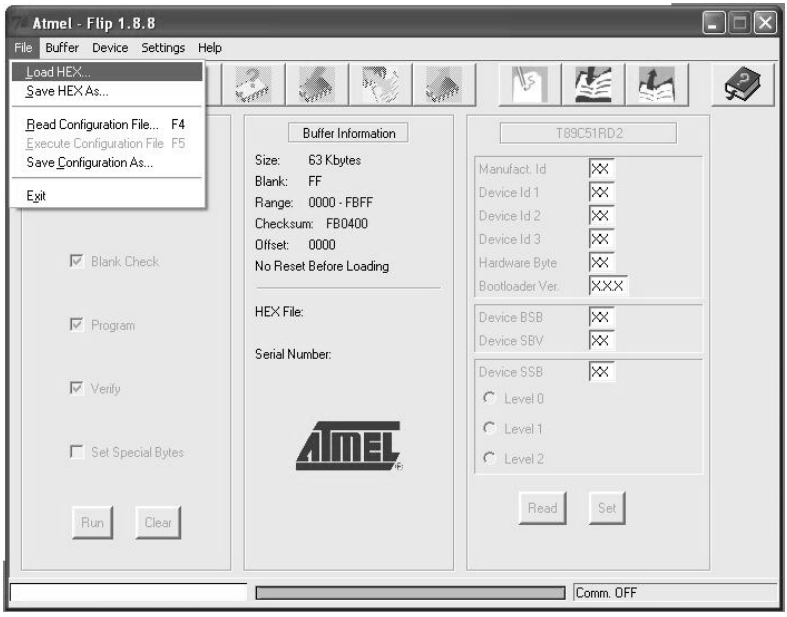


Figure 10: Loading the Hex

6. The Open File window opens. Select the correct HEX file that contains the updated version of the firmware for **PL-8** (for example ***44M_V1p2.hex***) and click Open.
7. Press the keyboard shortcut key *F3* (or select the "*Communication / RS232*" command from the *Settings* menu, or press the keys: *Alt SCR*). The "*RS232*" window appears. Change the COM port according to the configuration of your computer and select the 9600 baud rate:

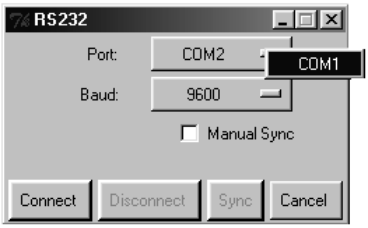


Figure 11: RS-232 Window

8. Click Connect.
   In the "*Atmel – Flip*" window, in the *Operations Flow* column, the *Run* button is active, and the name of the chip appears as the name of the third column: *AT89C51RD2*.
   Verify that in the *Buffer Information* column, the "*HEX File: PL8.hex*" appears.

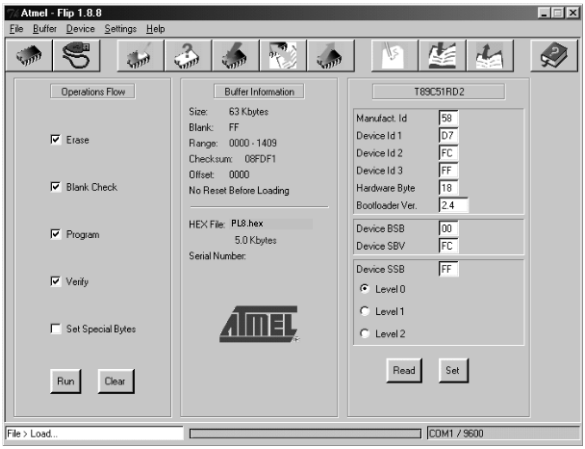


Figure 12: Atmel – Flip Window (Connected)

9. Click *Run*.
   After each stage of the operation is completed, the check-box for that stage becomes colored green[1].
   When the operation is completed, all 4 check-boxes will be colored green and the status bar message: *Memory Verify Pass* appears[2]:

1 See also the blue progress indicator on the status bar

2 If an error message: "Not Finished" shows, click Run again

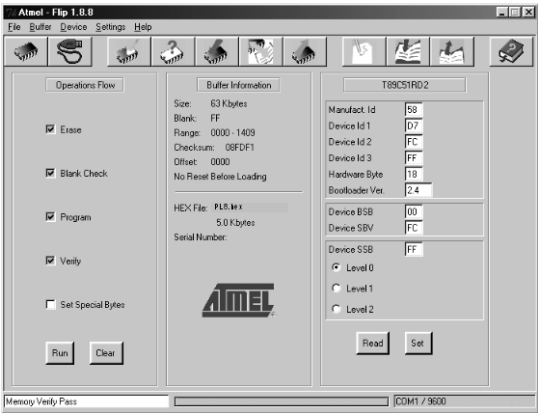


Figure 13: Atmel – Flip Window (Operation Completed)

10. Close the "*Atmel – Flip*" window.
11. Disconnect the power on the **PL-8**.
12. If required, disconnect the *RS-232* terminal block connector on the **PL-8** unit from the Null-modem adapter.
13. Slide the underside PROGRAM switch back to normal.
14. Connect the power to the **PL-8**.

7 Kramer Protocol[1]

By default, the **PL-8** is set to protocol 3000 (see section 7.1) but is also compatible with Kramer's Protocol 2000 (see section 7.2).

You can switch protocols by setting DIP-switch 8 OFF for protocol 3000 and ON for protocol 2000.

7.1 PL-8 Commands in Protocol 2000

This RS-232/RS-485 communication protocol uses four bytes of information as defined below. For RS-232, a null-modem connection between the machine and controller is used. The default data rate is 9600 baud, with no parity, 8 data bits and 1 stop bit.

1 You can download our user-friendly "Software for Calculating Hex Codes for Protocol 2000" from the technical support section on our Web site at: http://www.kramerelectronics.com

Table 4: Protocol Definitions

MSB							LSB
	DESTI-NATION	**INSTRUCTION**					
0	D	N5	N4	N3	N2	N1	N0
7	6	5	4	3	2	1	0
1st byte							
	INPUT						
1	I6	I5	I4	I3	I2	I1	I0
7	6	5	4	3	2	1	0
2nd byte							
	OUTPUT						
1	O6	O5	O4	O3	O2	O1	O0
7	6	5	4	3	2	1	0
3rd byte							
			MACHINE NUMBER				
1	OVR	X	M4	M3	M2	M1	M0
7	6	5	4	3	2	1	0
4th byte							

1st BYTE: Bit 7 – Defined as 0.
D – "DESTINATION": 0 - for sending information to the switchers (from the PC);
1 - for sending to the PC (from the switcher).
N5…N0 – "INSTRUCTION"
The function that is to be performed by the switcher(s) is defined by the INSTRUCTION (6 bits). Similarly, if a function is performed via the machine's keyboard, then these bits are set with the INSTRUCTION NO., which was performed. The instruction codes are defined according to the table below (INSTRUCTION NO. is the value to be set for N5…N0).

2nd BYTE: Bit 7 – Defined as 1.
I6…I0 – "INPUT".
When switching (ie. instruction codes 1 and 2), the INPUT (7 bits) is set as the input number which is to be switched. Similarly, if switching is done via the machine's front-panel, then these bits are set with the INPUT NUMBER which was switched. For other operations, these bits are defined according to the table.

3rd BYTE: Bit 7 – Defined as 1.
O6…O0 – "OUTPUT".
When switching (ie. instruction codes 1 and 2), the OUTPUT (7 bits) is set as the output number which is to be switched. Similarly, if switching is done via the machine's front-panel, then these bits are set with the OUTPUT NUMBER which was switched. For other operations, these bits are defined according to the table.

4th BYTE: Bit 7 – Defined as 1.
Bit 5 – Don't care.
OVR – Machine number override.
M4…M0 – MACHINE NUMBER.
Used to address machines in a system via their machine numbers. When several machines are controlled from a single serial port, they are usually configured together with each machine having an individual machine number. If the OVR bit is set, then all machine numbers will accept (implement) the command, and the addressed machine will reply.
For a single machine controlled via the serial port, always set M4…M0 = 1, and make sure that the machine itself is configured as MACHINE NUMBER = 1.

Table 5: Instruction Codes for Protocol 2000

Note: All values in the table are decimal, unless otherwise stated.

INSTRUCTION		DEFINITION FOR SPECIFIC INSTRUCTION		NOTE
#	DESCRIPTION	INPUT	OUTPUT	
0	RESET DEVICE	0	0	1
44	SWITCH RELAY DATA	Set equal to control data input which is to be switched 0=OFF 1=ON	Set equal to control data output which is to be switched	2,27
45	REQUEST STATUS OF RELAY DATA OUTPUT	0	Equal to output number whose status is reqd	3,4,27

INSTRUCTION		DEFINITION FOR SPECIFIC INSTRUCTION		NOTE
#	DESCRIPTION	INPUT	OUTPUT	
61	IDENTIFY MACHINE	video machine name audio machine name video software version audio software version RS422 controller name RS422 controller version remote control name remote software version Protocol 2000 revision Control data machine name Control data software version	Request first 4 digits Request first suffix Request second suffix Request third suffix Request first prefix Request second prefix Request third prefix	13

NOTES on the above table:
NOTE 1 – When the master switcher is reset, (e.g. when it is turned on), the reset code is sent to the PC. If this code is sent to the switchers, it will reset according to the present power-down settings.

NOTES on the above table:

NOTE 1 - When the master switcher is reset, (e.g. when it is turned on), the reset code is sent to the PC. If this code is sent to the switchers, it will reset according to the present power-down settings.

NOTE 2 - These are bi-directional definitions. That is, if the switcher receives the code, it will perform the instruction; and if the instruction is performed (due to a keystroke operation on the front panel), then these codes are sent. For example, if the HEX code
01 85 88 83
was sent from the PC, then the switcher (machine 3) will switch input 5 to output 8. If the user switched input 1 to output 7 via the front panel keypad, then the switcher will send HEX codes:
41 81 87 83
to the PC.
When the PC sends one of the commands in this group to the switcher, then, if the instruction is valid, the switcher replies by sending to the PC the same four bytes that it was sent (except for the first byte, where the DESTINATION bit is set high).

NOTE 3 - SETUP # 0 is the present setting. SETUP # 1 and higher are the settings saved in the switcher's memory, (i.e. those used for Store and Recall).

NOTE 4 - The reply to a "REQUEST" instruction is as follows: the same instruction and INPUT codes as were sent are returned, and the OUTPUT is assigned the value of the requested parameter. The replies to instructions 10 and 11 are as per the definitions in instructions 7 and 8 respectively. For example, if the present status of machine number 5 is breakaway setting, then the reply to the HEX code
0B 80 80 85
would be HEX codes
4B 80 81 85

NOTE 13 - This is a request to identify the switcher/s in the system. If the OUTPUT is set as 0, and the INPUT is set as 1, 2, 5 or 7, the machine will send its name. The reply is the decimal value of the INPUT and OUTPUT. For example, for a 2216, the reply to the request to send the audio machine name would be (HEX codes):
7D 96 90 81 (i.e. 128_{dec}+ 22_{dec} for 2nd byte, and 128_{dec}+ 16_{dec} for 3rd byte).

If the request for identification is sent with the INPUT set as 3 or 4, the appropriate machine will send its software version number. Again, the reply would be the decimal value of the INPUT and OUTPUT - the INPUT representing the number in front of the decimal point, and the OUTPUT representing the number after it. For example, for version 3.5, the reply to the request to send the version number would be (HEX codes):
7D 83 85 81 (i.e. 128_{dec}+ 3_{dec} for 2nd byte, 128_{dec}+ 5_{dec} for 3rd byte).

If the OUTPUT is set as 1, then the ASCII coding of the lettering following the machine's name is sent. For example, for the VS-7588YC, the reply to the request to send the first suffix would be (HEX codes):
7D D9 C3 81 (i.e. 128_{dec}+ ASCII for "Y"; 128_{dec}+ ASCII for "C").
NOTE 27 –Bit 6 in the Output byte defines direction of the switched DATA (RS-232,RS- 485, RS-422). For bit 6=0 the direction of the control DATA is from Input to Output; for bit 6=1 the direction of the reply DATA is oposite - from Output to the Input.

Command	Example
Set relay On (Open)	0x02,0x81,0x80+Relay,0081
Set relay Off (Close)	0x02,0x80,0x80+Relay,0081
Read relay status	0x03,0x80,0x80+Relay,0081

7.2 PL-8 Commands in Protocol 3000

This RS-232/RS-485 communication protocol[1] lets you control the machine from any standard terminal software (for example, Windows® HyperTerminal Application) and uses a data rate of 115200 baud, with no parity, 8 data bits, and 1 stop bit. This section describes all commands sent to the **PL-8**. For an explanation of the syntax and use of Protocol 3000, see section 7.2.4.

7.2.1 Operating Commands

Following are the specific commands that the room controller (RC device) sends to the **PL-8** to operate the external devices.

Command	Syntax	Response
Relay control	RELAY RELAY_NUM, STATE	RELAY RELAY_NUM , STATE RESULT
Parameter Description: RELAY_NUM = 1 to 8 STATE = Relay state: '0' or 'close' to close the relay '1' or 'open' to open the relay		

Command	Syntax	Response
Relay status	RELAY RELAY_NUM	RELAY RELAY_NUM RESULT
Parameter Description: RELAY_NUM = 1 to 8		

7.2.2 Identification Commands

Command	Syntax	Response
Read device model	MODEL?	MODEL MACHINE_MODEL
Read device firmware version	VERSION?	VERSION MAJOR .MINOR .BUILD .REVISION

7.2.3 Reset Command

Command	Syntax	Response
Reset device	RESET	RESET OK

7.2.4 K-NET management commands

Command	Syntax	Response
Change KNET number	KSET NEW_K_ID	KSET NEW_K_ID RESULT
Parameter Description: KNET_ID "1" or "Master" "2" … (Slave)		

1 Not available at the time of printing. Refer to our Web site at http://www.kramerelectronics.com for details

Note:
* Command required Admin login.
* New ID will done only after device resetting
* Connecting 2 devices with same ID over one KNET network could cause unexpected behavior.

7.3 Protocol 3000 Syntax

Protocol 3000 is used to control the **PL-8** via an RS-232 connection using a PC, touch screen, other serial controller or RC type controller.

7.3.1 Host Message Format

Start	Address (optional)	Body	Delimiter
#	*Destination_id@*	**Message**	**CR**

7.3.1.1 Simple Command

Command string with only one command without addressing:

Start	Body	Delimiter
#	**Command** **SP** *Parameter_1,Parameter_2,…*	**CR**

7.3.1.2 Command String

Formal syntax with commands concatenation and addressing:

Start	Address	Body	Delimiter
#	*Destination_id@*	**Command_1** *Parameter1_1,Parameter1_2,…*| **Command_2** *Parameter2_1,Parameter2_2,…*| **Command_3** *Parameter3_1,Parameter3_2,…*|…	**CR**

7.3.1.3 Device Message Format

Start	Address (optional)	Body	delimiter
~	*Sender_id@*	**Message**	**CR** **LF**

7.3.1.4 Device Long Response

Echoing command:

Start	Address (optional)	Body	Delimiter
~	*Sender_id@*	**Command** **SP** [*Param1 ,Param2 …*] **result**	**CR** **LF**

CR = Carriage return (ASCII 13 = 0x0D)
LF = Line feed (ASCII 10 = 0x0A)
SP = Space (ASCII 32 = 0x20)

7.3.2 Command Terms

Command
A sequence of ASCII letters ('A'-'Z', 'a'-'z' and '-').
Command and parameters must be separated by at least one space.

Parameters
A sequence of alphameric ASCII characters ('0'-'9','A'-'Z','a'-'z' and some special characters for specific commands). Parameters are separated by commas.

Message string
Every command entered as part of a message string begins with a **message starting character** and ends with a **message closing character**.
Note: A string can contain more than one command. Commands are separated by a pipe ('|') character.

Message starting character
'#' – For host command/query
'~' – For machine response

Device address (Optional, for K-NET)
K-NET Device ID followed by '@'

Query sign
'?' follows some commands to define a query request.

All outputs sign
'*' defines all outputs.

Message closing character
CR – For host messages; carriage return (ASCII 13)
CRLF – For machine messages; carriage return (ASCII 13) + line-feed (ASCII 10)

Command chain separator character
When a message string contains more then one command, a pipe ('|') character separates each command.

Spaces between parameters or command terms are ignored.

7.3.3 Entering Commands

You can directly enter all commands using a terminal with ASCII communications software, such as HyperTerminal, Hercules, etc. Connect the terminal to the serial, Ethernet, or USB port on the Kramer device. To enter **CR** , press the Enter key.
(LF is also sent but is ignored by command parser).

For commands sent from some non-Kramer controllers like Crestron, some characters require special coding (such as, /X##). Refer to the controller manual.

7.3.4 Command Forms

Some commands have short name syntax in addition to long name syntax to allow faster typing. The response is always in long syntax.

7.3.5 Command Chaining

Multiple commands can be chained in the same string. Each command is delimited by a pipe character ('|'). When chaining commands, enter the **message starting character** and the **message closing character** only once, at the beginning of the string and at the end.

Commands in the string do not execute until the closing character is entered.

A separate response is sent for every command in the chain.

7.3.6 Maximum String Length

64 characters

7.3.7 Backward Support

Protocol 2000 is transparently supported by Protocol 3000. You can switch between protocols using a switch protocol command from either platform.

8 Technical Specifications

Table 6 includes the technical specifications:

Table 6: Technical Specifications[1] *of the PL-8 Low Voltage Relay Controller*

INTERFACE:	RS-232 9-pin D-sub Connector 2 K-NET on terminal block connectors
OUTPUTS:	4 relays on terminal block connectors, NO: Normally Open; C: Common Voltage; NC: Normally Closed (36V AC or DC, 2A, 60VAC maximum on non-inductive load) 4 relays on terminal block connectors, NO: Normally Open; NC: Normally Closed (36V AC or DC, 2A, 60VAC maximum on non-inductive load)
CONTROL:	LEDs: LINK and ON
POWER SOURCE:	12V DC 130mA
DIMENSIONS:	12.1cm x 7.18cm x 2.42cm (4.76" x 2.83" x 0.95"), W, D, H
WEIGHT:	0.3kg. (0.67lbs) approx.
ACCESSORIES:	Power supply, mounting bracket

1 Specifications are subject to change without notice

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We welcome your questions, comments and feedback.

Safety Warning:
Disconnect the unit from the power supply before opening/servicing.

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